Section 8: Assessment and Tracking Progress

8.1 Introduction

Surveillance and monitoring provide essential information about the state of the Great Lakes ecosystem and measure the success of remediation and protection efforts. The Lake Erie LaMP is responsible for setting goals and identifying management actions to restore and protect the lake, and to track progress towards these goals. Once ecosystem objectives have been finalized and indicators have been developed, wherever possible, existing surveillance and monitoring programs will be used to track indicator changes. Where gaps in current programs exist, new programs may be developed.

In 2000, an inventory of monitoring programs in the Lake Erie basin was developed by Environment Canada based on a number of sources of information. Ninety-three independent monitoring programs were underway within the basin. These can be roughly divided into five monitoring categories (Table 7). Some of these monitoring programs are lakewide in nature. Others are more localized or created for a single specific purpose. Several of the monitoring programs that are more lakewide-oriented are described below. At this point, these are only examples of some of the programs that the Lake Erie LaMP may utilize, as the LaMP has not yet determined exactly how progress toward meeting LaMP goals will be tracked. U.S. EPA has begun to develop several tools that may be used to assist the LaMPs in monitoring progress and these are described below as well. Descriptions of several other monitoring programs are presented in other sections of the document.

Table 7: Summary of Ongoing Monitoring Efforts in Lake Erie in 2000

MONITORING CATEGORY	No.
Monitoring inputs/outputs of contaminants	19
Ambient contaminant (spatial, temporal, multimedia)	29
Populations (native and exotic) and habitat	34
Health effects monitoring	8
Exotics effects monitoring	10
TOTAL	**93**

8.2 The Lake Erie Millennium Plan

The Lake Erie Millennium Plan (www.uwindsor.ca/erie2001) was initiated in 1998 by scientists at the University of Windsor, National Water Research Institute - Burlington, F.T. Stone Lab of The Ohio State University, and U.S. EPA's Large Lakes Lab at Grosse Isle, Michigan. The purpose was to foster and coordinate research that will identify and solve basic ecological questions relevant to the Lake Erie ecosystem through a binational, collaborative network.

To be relevant to regional and binational groups responsible for Lake Erie's health, the research must address lake management needs as well as further basic knowledge of the ecosystem. To this end, the active sponsorship of agencies and organizations whose mandate concerns Lake Erie was solicited. Twelve binational, national, regional, state, and provincial organizations have contributed funds to sponsor Millennium Plan activities. Additionally, 13 collaborating organizations are active participants in the planning, information transfer or research aspects of the Millennium Plan, providing in-kind and/or technical support that further Plan activities. Goals of the Lake Erie Millennium Plan are:

- To collectively document the research and management needs of users and agencies;
- To summarize the current status of Lake Erie from process and ecosystem function perspectives; and
- To develop a framework for a binational research network to ensure coordinated collection and dissemination of data that address research and management needs.

Activities since the Lake Erie LaMP 2000 Report include:

- Lake Erie in the Millennium Binational Conference – Progress and New Issues, March 28-29, 2001
- State of the Strait – Status and Trends in the Detroit River Ecosystem, March 27, 2001
- Contaminants in Lake Erie, September 11-12, 2000

8.3 Marsh Monitoring Program

Since 1995, this volunteer based program has engaged both professional and dedicated citizen naturalists throughout the Great Lakes region (including Lake Erie) to record and monitor annual trends in populations of several calling amphibian (frogs and toads) and marsh bird species in important marshes throughout the basin. Information gathered through the Marsh Monitoring Program is relevant for assessing relative population changes in these species at local, regional and basinwide scales, and can be useful for gauging the status and ecological integrity of marshes at each of these scales.

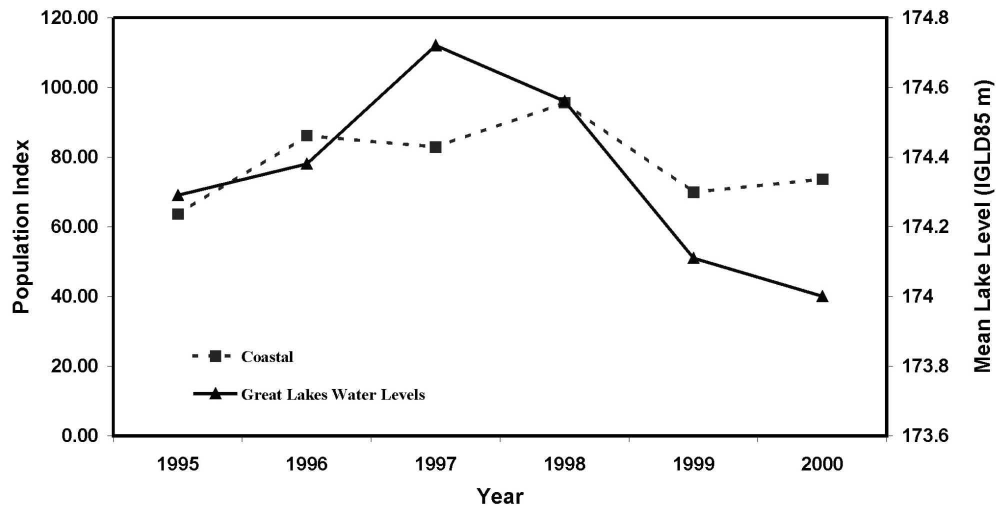
Results (1995-2000) suggest that there appears to be a relationship emerging between population trends of some marsh bird and amphibian species in coastal marshes and the trend in Lake Erie’s mean annual water levels, especially since 1997, the year that marked the end of the last sustained high water period. For example, black tern and sora trends at coastal marshes have followed a similar pattern to that of Lake Erie’s water levels. Similarly, trends for aquatic amphibian species such as green frog and northern leopard frog have closely reflected the trend in Lake Erie’s water levels at coastal marshes. Conversely, trends for certain marsh bird species preferring drier marsh edge habitat have increased at coastal marshes during recent lake level declines. For example, the trend for common yellowthroat (a warbler that prefers marsh edge) at coastal Marsh Monitoring Program routes has been inversely related to Lake Erie’s water levels (Figure 4).

These relations could be explained, in part, by spatial movement of certain species into or out of Marsh Monitoring Program survey routes. Alternatively, as lake levels declined, if appropriate marsh habitat was not replaced at the rate at which it was lost, and appropriate marsh habitat was either not available elsewhere or was already at its carrying capacity, then declining trends in highly marsh dependent birds and amphibians may well be indicative of overall population declines.

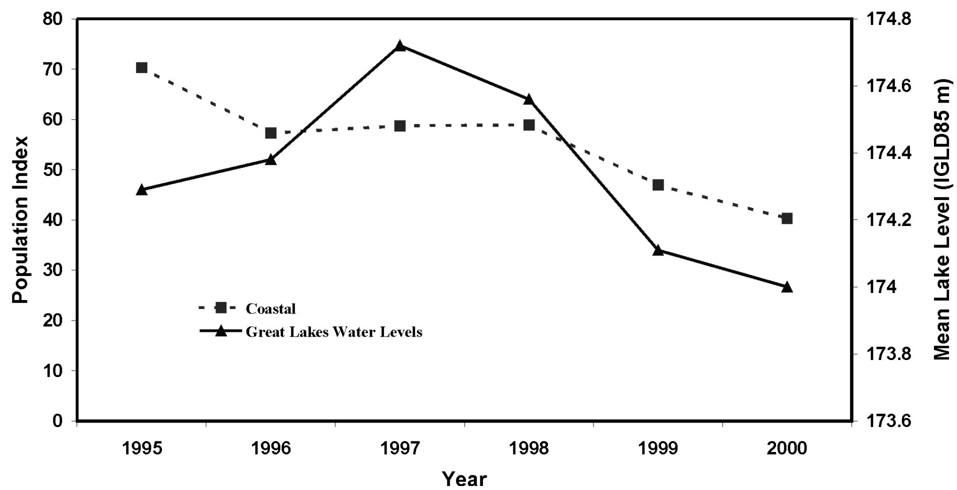
Although current lake levels are near their long-term lows, because lake levels fluctuate, and trends in certain marsh bird and amphibian species at coastal marshes appear to respond to changing lake levels (positively or negatively), when Lake Erie’s levels begin to increase again, these responses should be detected by Marsh Monitoring Program data. Only by taking into account the dynamic nature of coastal marsh habitats can one examine what is really happening to populations of marsh birds and amphibians in the Lake Erie basin.

Figure 4: Lake Erie Basin-wide Trends in Relative Abundance of Selected Marsh Bird and Amphibian Species Compared to Mean Annual Water Levels of Lake Erie from 1995 to 2000. For each species, trends are presented for marshes monitored at coastal locations (i.e. within 5 km/3 miles from a lake shore).

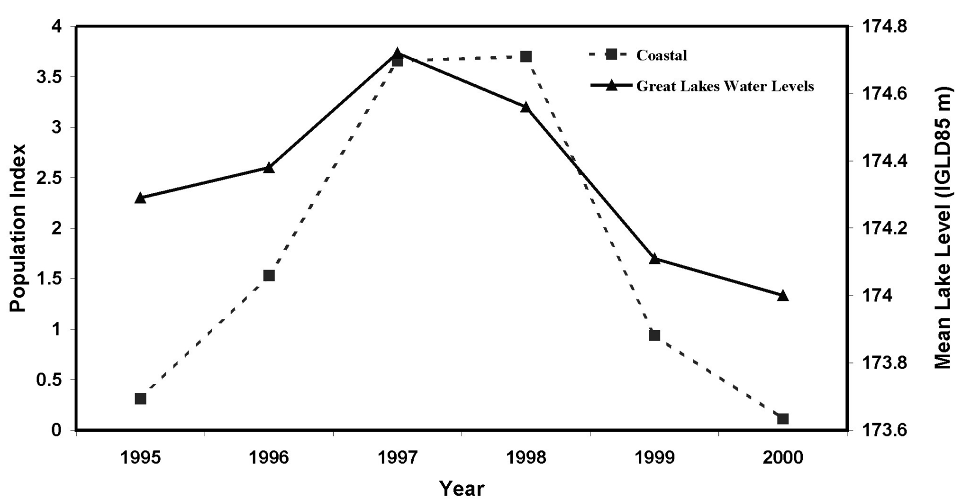
Leopard Frog

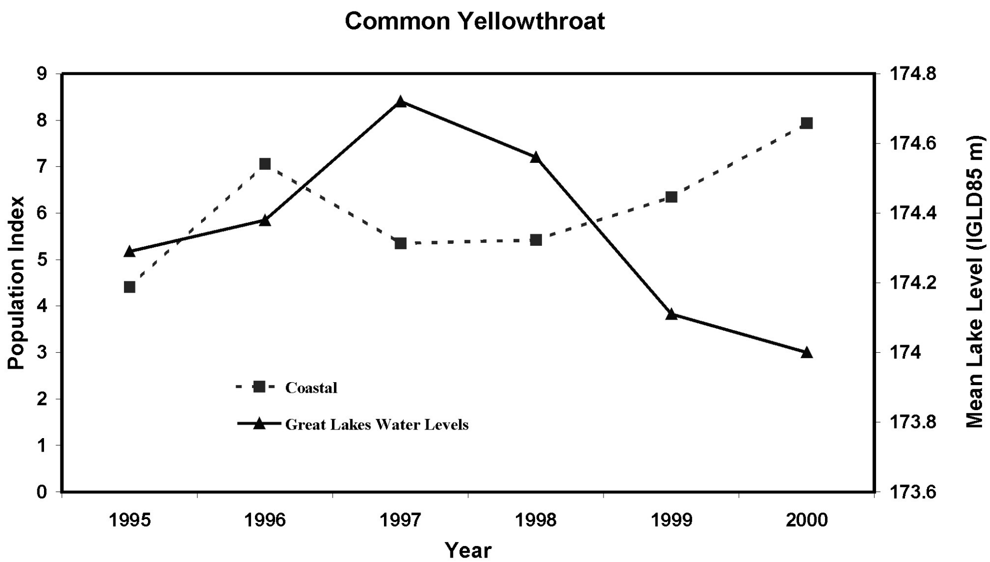


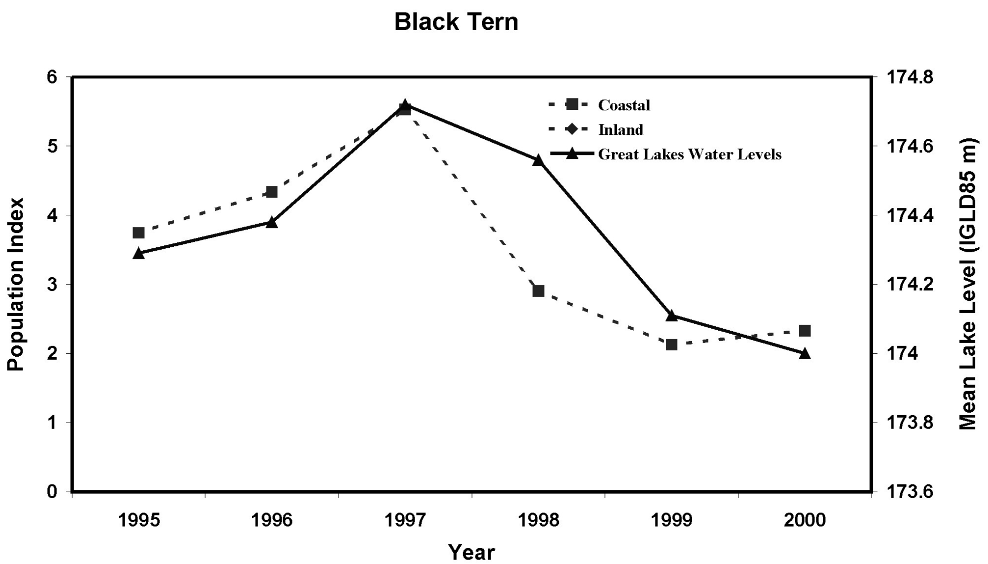
Green Frog

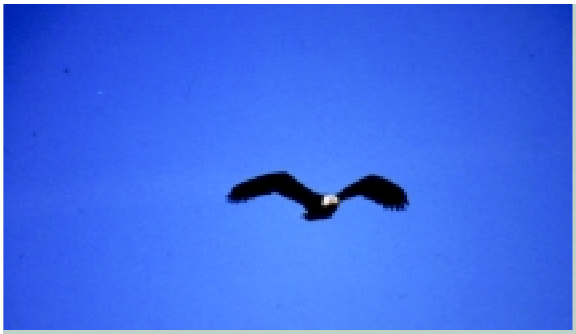


Sora









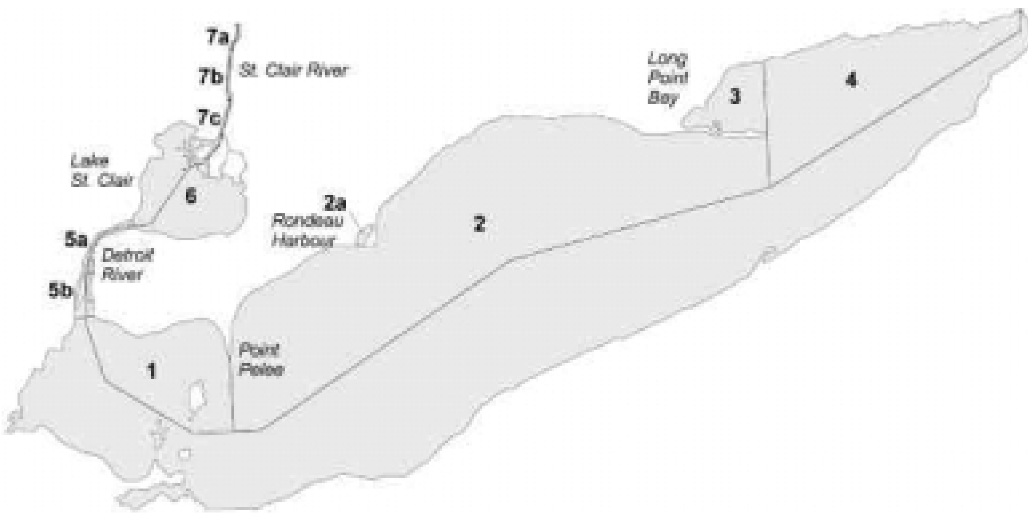
Bald Eagle Update

The status of the bald eagle population around the lake has been a highly visible indicator of the state of Lake Erie. Most of the bald eagles nesting in the Lake Erie basin are found in Ohio, particularly in the marshes in the western basin. The 2001 nesting year was excellent for Ohio Lake Erie eagles with an 83% success rate and an average 1.4 fledglings per nest. Sixty-three nesting pairs produced 89 fledglings. Weather related impacts were not experienced this year due to an absence of severe storms and strong winds. Younger birds are starting to build nests closer to human disturbance, and more nests are being found further east. Although populations continue to increase, there is still a missing definitive link between eagle reproductive success and contaminants. Failure in the nests of some of the older birds suggests contaminants may still be having an impact on reproduction (Shieldcastle, personal communication). The Ohio Lake Erie Protection Fund provided a grant in 2000 to analyze blood and feather samples collected and archived by the Ohio Department of Natural Resources in the 1990s. The samples to be analyzed are from younger nestlings and more comparable to other Great Lakes eagle samples. Previous analysis of nestling blood from Ohio eagles in the late 1980s found great concentrations of PCBs and DDE. The bald eagle blood work results should be available in 2002.

8.4 Trends in Contaminants in Ontario's Lake Erie Sport Fish

Sport fish contaminant monitoring in Ontario is coordinated by the Ontario Ministry of the Environment and conducted in partnership with the Ontario Ministry of Natural Resources. Sport fish from the Canadian waters of Lake Erie have been monitored on a regular basis for contaminants since the 1970s. Size and species-specific consumption advisories for different regions or blocks of the lake (Figure 5) are provided to the public in the Guide to Eating Ontario Sport Fish.

Figure 5: Lake Erie Blocks



Consumption advisories, provided as the recommended maximum number of meals per month, are based on health protection guidelines developed by Health Canada. Consumption restrictions on Lake Erie sport fish are caused by PCBs (70%) and mercury (30%). Other contaminants such as DDT and metabolites, hexachlorobenzene, octachlorostyrene, chlordane and lindane are often detected in Lake Erie sport fish, but do not cause consumption restrictions, and concentrations have declined over the years. In recent years, dioxins and furans have been monitored in species expected to have the highest concentrations (e.g. carp, lake whitefish), but have not caused consumption restrictions. Comparing data across the Canadian waters of the Great Lakes, Lake Erie has the lowest proportion of sport fish species with consumption restrictions at 17.4%. The proportion of sport fish species with consumption restrictions in the Canadian waters of the other Great Lakes ranges from 21.1% in Lake Huron to 43.0% in Lake Ontario.

In order to report on spatial and temporal trends in contaminants, a "standard size" was selected for each species. The standard size was close to the mean length for the species in the database and typical of the size caught and consumed by anglers. Contaminants in standard size sport fish for the last 10 years were used to evaluate spatial trends. Contaminant data from Block 1 from 1976-2000 were separated into 5-year intervals for temporal trend evaluation. Species selection was based on the availability of data.

Mercury concentrations exhibit no spatial patterns across Lake Erie blocks. Mercury concentrations in 30 cm (12 inch) white bass ranged from 0.09 to 0.15 ppm and in 45 cm (18 inch) walleye from 0.10-0.13 ppm. For both species there was no significant difference across the three major blocks of Lake Erie (Figures 6 and 7). Block 3 (Long Point Bay) was excluded from the statistical analysis because of the lack of replicate data. Over the past 25 years, mercury concentrations in Lake Erie sport fish have declined. When a comparison was made of the mercury concentrations in white bass in 5 year intervals between 1976 and 2000 it was found that mean concentrations in 30 cm (12 inch) white bass decreased significantly from 0.22 ppm in the first period (1976-1980) to 0.13 ppm in the last period (1996-2000). The same was found for walleye. Mean mercury concentration in 45 cm (18 inch) walleye decreased from 0.30 ppm to 0.12 ppm in the same time period (Figures 8 and 9). Most of the decrease occurred between the 1976-1980 period and 1981-1985. Between 1981-1985 and 1996-2000, there was no significant difference in mercury concentrations in either white bass or walleye. Mercury concentrations in most Lake Erie sport fish are low and only the largest individuals tend to exceed the consumption guideline of 0.45 ppm. White bass and walleye do not exceed the guideline until they exceed 40 cm (16 inches) and 70 cm (27 inches) in length respectively (Figure 10).

Analysis of spatial patterns of PCBs for 30 cm white bass suggests that there is little difference in PCB concentrations between blocks in Lake Erie (Figure 11). Lower levels found in block 4 are based on only one year of data so statistical significance could not be determined. Over the past 25 years, PCB concentrations in some but not all species of Lake Erie sport fish have decreased. Mean PCB concentrations in 30 cm white bass decreased significantly from 615 ppb in 1976-1980 to 242 ppb in 1996-2000 (Figure 12). Most of the decrease occurred between the 1976-1980 and 1981-1985 periods.

Figure 6: Mercury Concentrations in 30 cm (12 inch) White Bass Across Lake Erie 1990-2000

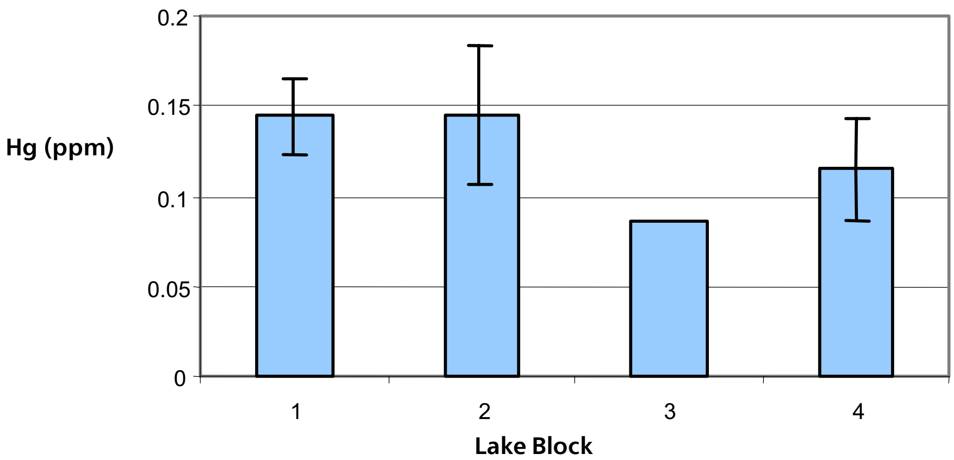


Figure 7: Mercury Concentrations in 45 cm (18 inch) Walleye Across Lake Erie 1990-2000

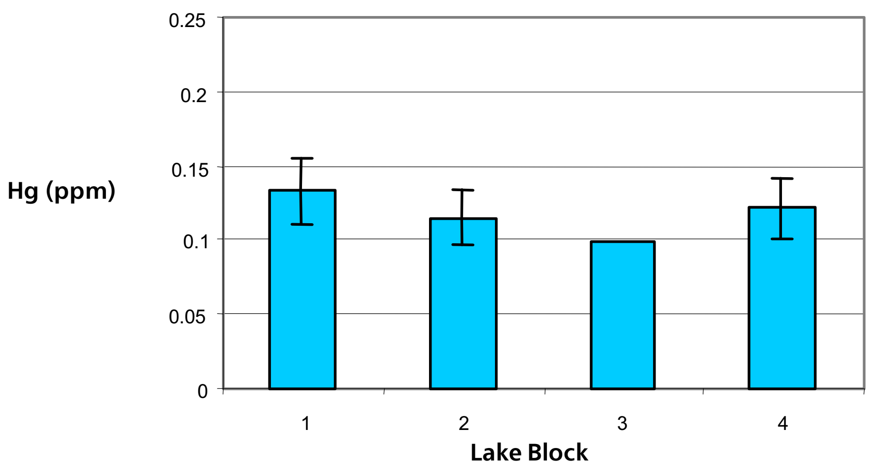


Figure 8: Mercury Concentrations in 30 cm (12 inch) White Bass Over Time in Lake Erie Block 1

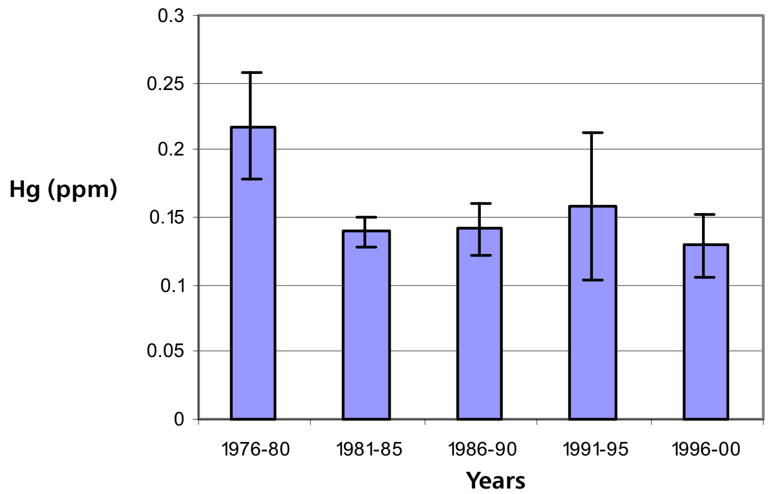


Figure 9: Mercury Concentrations in 45 cm (18 inch) Walleye Over Time in Lake Erie Block 1

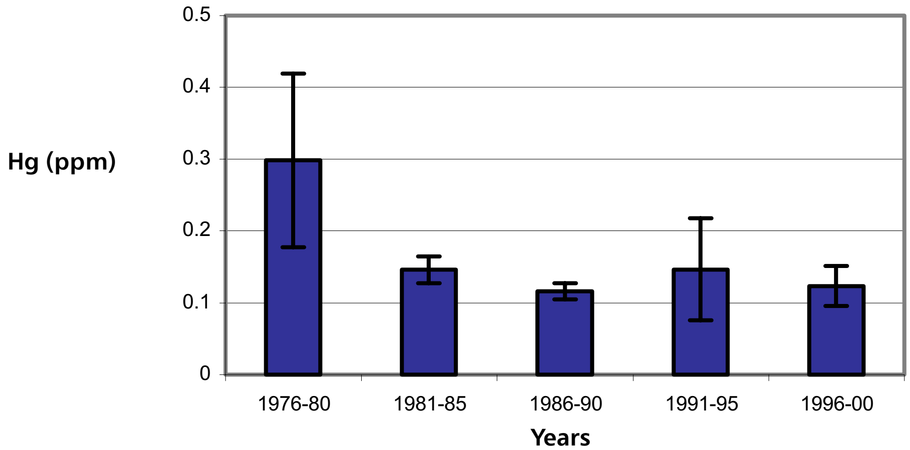


Figure 10: Mercury Concentration vs. Length in Walleye and Bass from Lake Erie Block 1

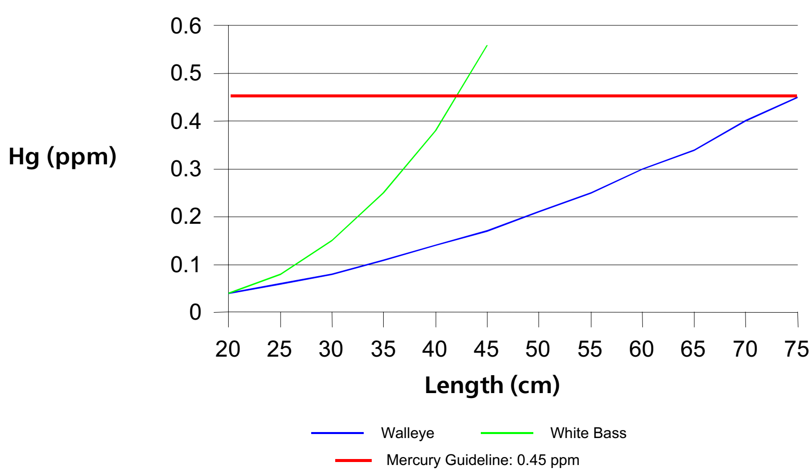


Figure 11: PCB Concentrations in 30 cm (12 inch) White Bass Across Lake Erie 1990 - 2000

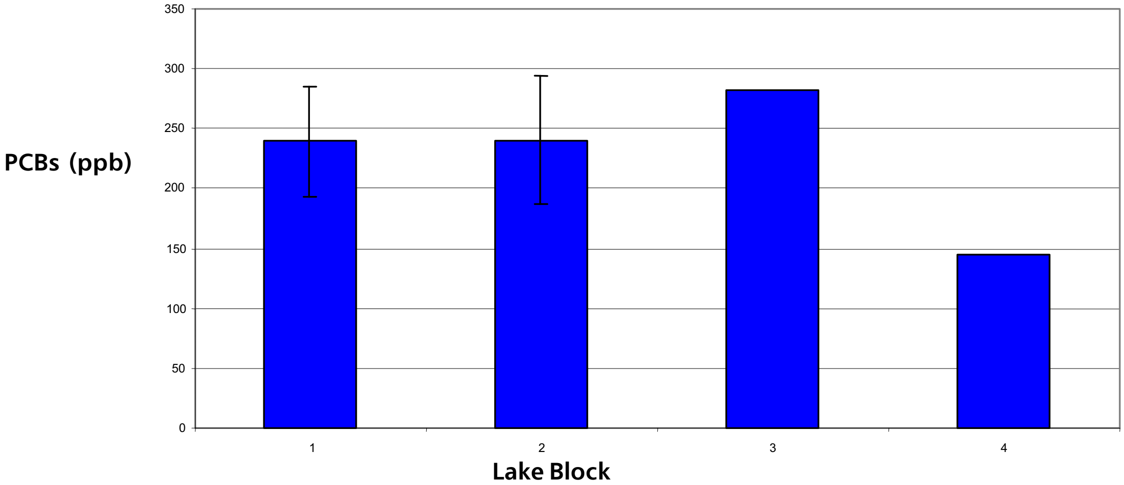


Figure 12: PCB Concentrations in 30 cm (12 inch) White Bass Over Time in Lake Erie Block 1

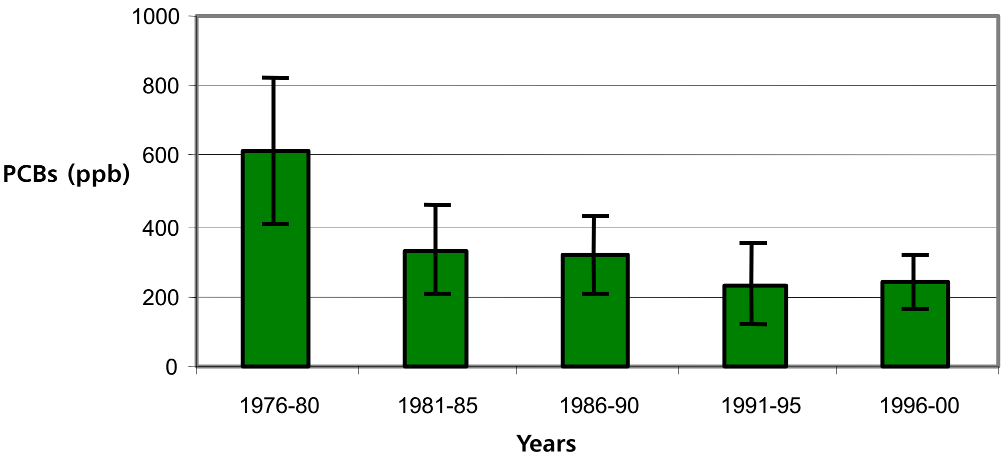


Figure 13: PCB Concentrations in 45 cm (18 inch) Channel Catfish in Lake Erie Block 1

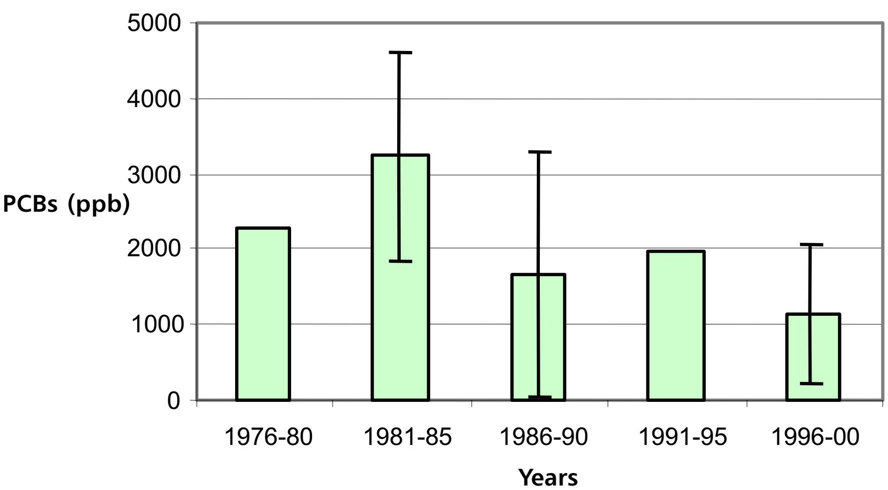


Figure 14: PCB Concentrations in 65 cm (25 inch) Carp in Lake Erie Block 1

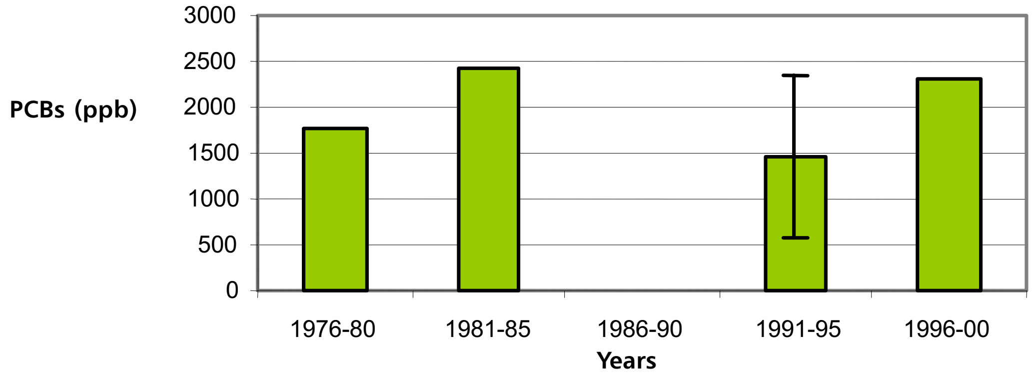
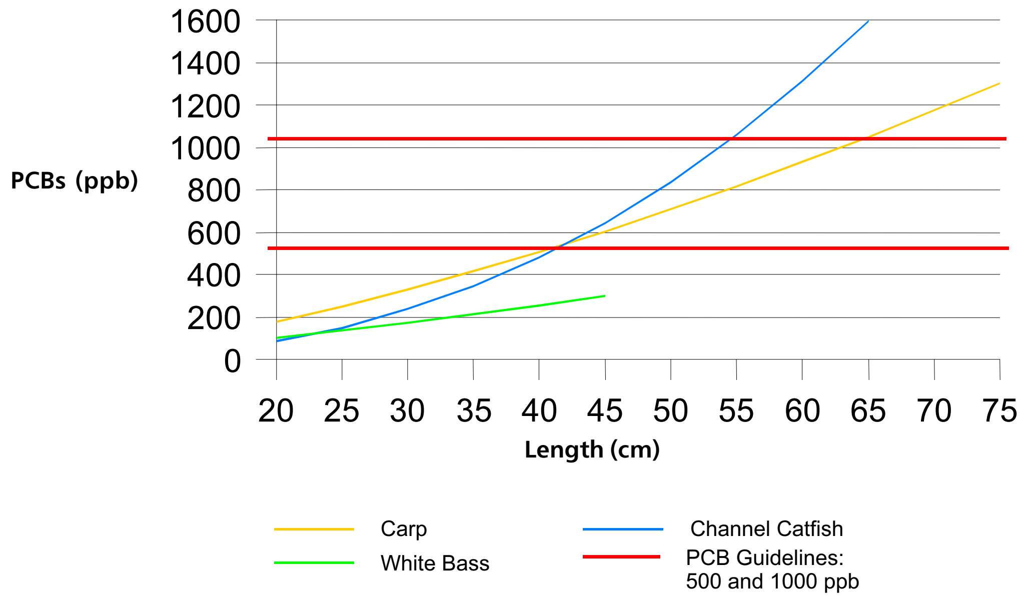


Figure 15: PCB Concentration vs. Length in Fish from Lake Erie Block 1



PCB concentrations in channel catfish appear to have decreased (Figure 13) but lack of replicate data for some periods prevented statistical confirmation. The highest PCB concentrations were found in 1981-1985 (3225 ppb). By the 1996-2000 period mean PCB concentrations had declined to 1143 ppb. PCB concentrations in carp do not appear to have declined over the period of sampling and in the most recent period (1996-2000) were still in excess of 2000 ppb (Figure 14). Differences among species may be due to the residual effects of sediment-bound PCBs. Pelagic species such as white bass would be less affected by sediment-bound PCBs than benthic-feeding species such as carp. Although PCB concentrations are low in most Lake Erie sport fish, high lipid species such as channel catfish and carp exceed the consumption guideline of 500 ppb even in relatively small individuals (Figure 15).

The Ontario Ministry of the Environment, through the Sport Fish Contaminant Monitoring Program, continues to monitor Lake Erie sport fish for trends in contaminant concentrations and provides consumption advice to anglers.

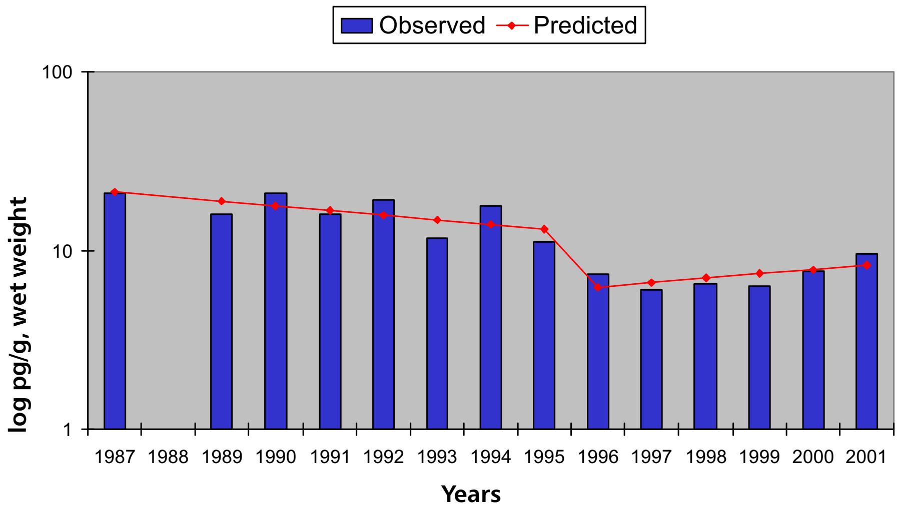
8.5 Trends in Contaminant and Population Levels of Colonial Waterbirds

The Wildlife Toxicology Section of the Canadian Wildlife Service (Ontario Region) maintains two wildlife-monitoring programs on the Great Lakes: contaminants in herring gull eggs and population levels of breeding colonial waterbirds. The former program was last reported on for the two Lake Erie sites, Middle Island and Port Colborne Breakwall, in 1999. The latter program is only conducted in its entirety once every decade and the most recent report is now available.

Contaminant levels in herring gull eggs do not change very much from year to year, and year-to-year changes do not necessarily have much meaning in long-term trends. Significant changes in long-term trends are usually only seen over several years. For example, Figure 16 illustrates an increase in 2,3,7,8 TCDD (dioxin) in herring gull eggs at Middle Island over the last three years, but compared to longer-term observations, there is not an increasing or decreasing trend. Figure 17 likewise shows an increase in PCB in herring gull eggs at the Port Colborne site in 2001, but the overall long-term trend is downward. The overall changes in concentrations of the other contaminants measured under this monitoring program (DDE, hexachlorobenzene, mirex, heptachlor epoxide and dieldrin) were variable over the last three years, but the overall trend is significantly downward.

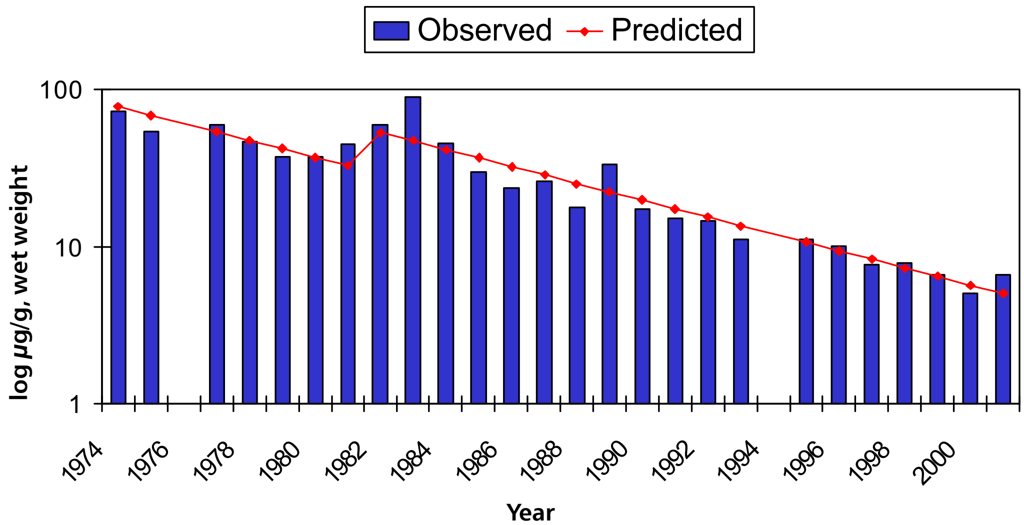
Breeding populations of colonial waterbirds on Lake Erie were surveyed in the late 1970s, 1980s and the 1990s. During the last two decades, populations of herring and ring-billed gulls and common terns have declined from 14.7 to 18.3%. This is consistent with similar patterns for these species in the other Great Lakes. The number of breeding gulls has declined probably as a result of artificially high population levels in the 1980s, when forage fish populations were larger. Common terns have declined probably as a result of ongoing nest-site competition with ring-billed gulls. Double-crested cormorant populations in Lake Erie have increased 211% since the late 1980s. Their populations have been increasing in each of the Great Lakes since the late 1970s. Great black-backed gulls and Caspian terns have just started nesting in Lake Erie (at Mohawk Island at the mouth of the Grand River) and have not yet established themselves there on an annual basis.

Figure 16: 2378-TCDD in Herring Gull Eggs - Middle I., 1987-2001



Model shows a significant decline before the change point year in 1996 and a non-significant trend after the change point.

Figure 17: PCB 1:1 in Herring Gull Eggs - Port Colborne, 1974-2001



Model shows the same significant rate of decline before and after the change point in 1982.

Photo: National Parks Service

8.6 Ohio Lake Erie Quality Index

In 1998, the Ohio Lake Erie Commission released the Lake Erie Quality Index Report. For this report ten indicators were developed to measure environmental, economic and recreational conditions as related to the quality of life enjoyed by those living near or utilizing the Ohio waters of Lake Erie. Each indicator is composed of several metrics that were selected because they were measurable goals or endpoints against which progress could be established and, in most cases, some regular monitoring was already being done. The Lake Erie Quality Index will be updated every five years, and work is currently underway to develop or refine metrics to be reported out on in 2003. In 2000, the Ohio Lake Erie Commission released the Ohio Lake Erie Protection and Restoration Plan, a long-term strategy of what the State of Ohio and its partners need to do to achieve the goals set by the Lake Erie Quality Index. The indicators selected for use in the Lake Erie Quality Index are presented in Table 8 along with the ratings assigned to them in the 1998 Lake Erie Quality Index Report.

Table 8: Ohio Lake Erie Quality Index Indicators

Indicator		Rating	
	Excellent	Good	Fair
Water Quality		Good	
Pollution Sources			Fair
Habitat			Fair
Biological		Good	
Coastal Recreation		Good	
Boating		Good	
Fishing	Excellent		
Beaches		Good	
Tourism	Excellent		
Shipping			Fair

8.7 U.S. EPA LaMP Project Tracking Database

The U.S. EPA has recently developed a computer database to track U.S. progress of U.S. projects identified in LaMP documents. Initially, this database consists of information on projects listed in the Lake Erie LaMP 2000 document. For example, projects listed in the PCB and mercury action plans are included in this database. Information on these projects is to be periodically updated. In addition, new projects described in future LaMP documents could be listed as well. Accessing this database allows interested parties, as well as agency staff, to review progress of LaMP projects without waiting for the publication of LaMP documents. This database will be available at the following web address: http://epa.gov/glnpo/lakes.html.

8.8 U.S. EPA GIS Tool to Characterize Landscapes Based on Ecosystem Health

The Critical Ecosystems Team from U.S. EPA Region 5 has developed a GIS based tool that can characterize landscapes based on three criteria: 1) ecological diversity; 2) sustainability; and 3) rare species or land cover types. The combination of these three criteria identifies the ecosystems with the highest quality or health. The tool is in the process of being peer reviewed, and should be ready for general application by the end of 2002. Teams and programs within the U.S. EPA can use the tool in a number of ways. For example, areas of highest quality can be located and mapped with the boundaries of state and federal protected areas. This will highlight ecosystems that are not currently under management or protection. Areas of highest diversity can be mapped against areas of lowest sustainability to highlight the richest ecosystems that are currently being threatened by chemical, biological or physical stresses. Once these ecosystems are identified, partners can use this information to assist in prioritizing remedial actions.

8.9 State of the Lakes Ecosystem Conference (SOLEC)

In response to a reporting requirement of the Great Lakes Water Quality Agreement, in 1994 U.S. EPA and Environment Canada initiated the State of the Lakes Ecosystem Conference, more universally known as SOLEC. It provides a forum for the exchange of information on the ecological condition of the Great Lakes and surrounding lands. SOLEC focuses on the state of the Great Lakes ecosystem and the major factors impacting it, rather than on the status of programs needed for protection and restoration, which is more of the LaMPs' role. In 1998, SOLEC began an effort to develop standard indicators that could be used to better report out on the status of the Great Lakes in a more consistent manner. SOLEC reviewed a number of possible indicators and is currently refining a list of 80 for their potential utility in measuring conditions across the Great Lakes. The work of the SOLEC team will be utilized wherever possible as the Lake Erie LaMP develops the indicators that it will use to track Lake Erie LaMP progress. In 2002, SOLEC will focus on indicators of biological integrity.